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British West Indies Central Sugar Cane Breeding Station, Barbados.

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FOURTH ANNUAL REPORT

ENDING SEPTEMBER 30, 1937.

ADVOCATE CO., LTD., Printers to the Government of Barbados.

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BRITISH WEST INDIES SUGAR CANE BREEDING STATION.

ADVISORY COMMITTEE.

Chairman—S. J. Saint, M.Sc., Ph.D., F.I.C. (London), Director of Agriculture, Barbados.

Members—Sir Geoffrey Evans, Kt., M.A., C.I.E., Principal of the Imperial College of Tropical Agriculture, Trinidad.

Hon. E. J. Wortley, C.M.G., O.B.E., Director of Agriculture, Trinidad.

Hon. A. C. Barnes, C.M.G., B.Sc., F.I.C., A.M.I.Ch.E., Director of Agriculture, Jamaica.

G. A. Jones, Dip. Agric., (Bangor), Commissioner of Agriculture of the Agricultural Advisory Department of the Imperial College of Tropical Agriculture, Trinidad.

Geneticist—A. E. S. McIntosh, B.Sc., Ph.D. (Edin.)

Assistant Botanist—G. C. Stevenson, B.A., A.I.C.T.A.

Agricultural Assistant—A. D. Herbert, D.I.C.T.A.

„ „ —J. N. W. Niccolls.

FOREWORD.

The end of the present financial year viz. September 30, 1937, marks the end of the period during which the British West Indies Central Sugar Cane Breeding Station has been dependent for its existence on financial assistance from the Colonial Development Fund. During the present year, with which this fourth annual report deals, the Colonial Development Fund and the contributing colonies have shared the burden of the £2,000 which was considered necessary in 1932 for the extension of the sugar cane breeding work to provide more fully for the needs of the other British West Indian Colonies. Next year the full annual grant will be contributed by the Colonies served by this Station.

It is desired to express and record the appreciation which is felt for the financial help rendered from the Colonial Development Fund since 1932. This help has rendered possible the establishment and development of this Station and so enabled new sugar cane breeding work to be inaugurated in Barbados with the object of producing seedling canes specifically suited to the wide range of conditions existing in the British West Indian sugar cane growing Colonies.

During the year under review, the work of the Station has progressed most favourably, and may be summarized as follows:—

Noble Cane Seedlings.

It is gratifying to note that the varieties B.726 and, more especially, B.2935 which were distributed before the establishment and functioning of the Plant Quarantine Station in Trinidad have already become established as commercial varieties in several Colonies. The first consignment of noble cane seedlings sent to the Plant Quarantine Station have been released, received and multiplied by the Colonies to which they were assigned by the station. These seedlings must, of course, be given suitable trials in appropriate areas but it may be mentioned, that of this series, the seedlings B.3013 and B.3127 have shown considerable promise in Barbados.

Nobilised Seedlings.

It is regrettable that two of this type of seedlings which were sent in 1935 to the Plant Quarantine Station for subsequent despatch to Jamaica for mosaic disease resistance tests died in quarantine. These seedlings were again despatched to the Plant Quarantine Station during the year under review.

During 1936 and 1937, twenty-seven different nobilised seedlings were sent to the Plant Quarantine Station. On release from quarantine these seedlings will be tested under one of two sets of conditions, viz. (1) thick-cane mosaic areas in Jamaica, or (2) thin-cane areas in Trinidad, Jamaica and Antigua.

It may be noted that the consignment despatched to the Plant Quarantine Station in 1936 has now been released to the appropriate Colonies.

Special Investigations.

These investigations include (1) growth measurements of seedlings, (2) gumming disease investigations, (3) the use of the Zeiss Hand Refractometer in determining comparative maturation of seedlings, (4) the phenomena of cane rotting and (5) the differential response of seedlings to ratooning.

It is hoped that these investigations will yield further data to assist the staff of the Station in the difficult task of early seedling selection.

Advisory Committee.

The sixth meeting of the Advisory Committee was held in Trinidad in January 1937 . A report of this meeting has already been published and circulated.

Visits of Inspection by the Geneticist.

During the year the Geneticist visited Trinidad, Grenada, Antigua and St. Kitts. Short notes on these visits are included under Section III of this report whilst detailed reports on the visits to Grenada and to St. Kitts and Antigua are published in Station Bulletins Nos. 13 and 15 respectively.

The importance of the interchange of detailed information which arises out of these visits cannot be over emphasised. The information so obtained helps to guide the breeding work and at the same same time leads to a fuller use of the work of the Station. Owing to the limited funds available for travelling it is regretted that only one visit has been paid by the Geneticist to Jamaica since the inception of the Station. This matter will be discussed at the next meeting of the Advisory Committee and it is hoped that arrangements can be made to enable the Geneticist to visit Jamaica every other year.

Personnel.

In July of this year, the Chairman of the Advisory Committee, Mr. R. W. R. Miller, proceeded on leave prior to the taking up of the appointment of Director of Agriculture, Zanzibar. Mr. Miller who was the first Chairman of the Advisory Committee was mainly responsible for the organisation of the Station at its inception and the continued progress which the Station has maintained since that time has been largely due to the energetic services which Mr. Miller has rendered. It is desired to record the appreciation of those valued services.

S. J. SAINT,

Director of Agriculture, Barbados,
Chairman, Advisory Committee.

British West Indies Central Sugar Cane Breeding Station.

REPORT FOR THE YEAR ENDING SEPTEMBER 30, 1937.

I. SUGAR CANE BREEDING, SEEDLING SELECTION AND TRIALS.

(i) SUGAR CANE BREEDING—B. 39′ SERIES.

Sugar Cane Breeding was carried out at Lion Castle during October, November and December, 1936.

In all, seventy-nine crosses were made. Details of the crosses made, and for each, the germinations, numbers potted and planted in the field nursery at Codrington are given in Appendix I. A summary is given below:

Group.	No. Crosses.	No. Germinations. (Nov.-Dec. 1936).	No. Potted (Jan.-Feb. 1937).	No. planted in field Nursery (Mar.-Apr. 1937).
Proven Cross (*Saccharum officinarum*)	5	32,331	9,328	6,302
Semi-Proven Cross (*Saccharum officinarum*)	9	5,591	4,132	3,321
Experimental Crosses Nobilisations. (a) *Saccharum spontaneum*				
(i) India	3	999	460	386
(ii) Celebes	4	983	367	326
(iii) Java	31	31,190	2,620	2,135
(b) *Saccharum barberi*	6	1,151	635	520
(c) *Saccharum sinense*	4	89	81	60
(d) Crosses involving several species of *Saccharum*	17	10,596	1,713	1,423
Totals	79	82,930	19,336	14,473

On account of the poor performances of their populations in the first year seedling trial of the B.37′ series (see note in section (iii) below) the following crosses are eliminated from future breeding:—

Ba.11569 x S. C. 12/4.
" x Burke.
" x D. 625.

The following will be promoted from the semi-proven to proven cross group:—

Ba.11569 x B.6450
" x B.6835

Points of interest arising out of the breeding work are noted. The wild variety Dacca gave a satisfactory number of seedlings while, once again, Co. 213 proved rather infertile.

For the first time, second nobilisations with Barbados varieties of the following were obtained:—*Saccharum spontaneum* (India), Java Kassoer and Synthetic Kassoer, Uba.

The nobilisation of chunnee (*S. barberi*) has been taken to the fourth degree, while that of Java glagah has reached the 6th degree. No further degree in nobilisation of the latter will be made. Breeding here will be confined to finding the best parents in the existing material of nobilised Java glagah in Barbados.

(II) PLANTING THE FIRST YEAR SEEDLING TRIAL—B.38′ SERIES.

These seedlings were bred in 1935, and planted into a field nursery in April 1936. In October of the same year selections were made in the field nursery to plant the First Year Seedling Trial for season 1936-38.

The details of the nursery and First Year Seedling Trial plantings are presented in Appendix II. A summary is given here:—

Group.	No. Crosses	No. in Field Nursery	No. planted in First Year Seedling Trial.
Proven Crosses (*Saccharum officinarum*)	5	3,465	1,858
Semi-Proven Crosses (*Saccharum officinarum*)	12	4,605	2,651
Experimental Crosses Nobilisations.			
(a) *S. spontaneum*			
(i) Celebes	1	30	24
(ii) Java	29	3,912	2,445
(b) *S. barberi*	4	127	103
(c) *S. sinense*	2	80	25
(d) mixed derivation	12	2,428	1,203
	65	14,647	8,309

During the work of selecting in the nursery, notes were taken on the appearance of experimental crosses.

In the list of the individual crosses shown—Appendix II, the following are of special interest:—

Ba.11569 x Badila
B.3013 x B.H.10(12).

Of the former cross, 397 seedlings were planted, and of the latter 91. This is the first occasion on which seedlings of Badila have been obtained; the year 1935 being the only year so far in which it has arrowed. In view of the excellence of both varieties, B. 3013 and B.H.10(12), many of the seedlings derived from crossing them may reasonably be expected to be of a high standard.

(III) RESULTS OF REAPING THE FIRST YEAR SEEDLING TRIAL—B.37′ SERIES.

These were bred in 1934, planted into a field nursery in 1935 and selected from the nursery and planted into the First Year Seedling Trial in October of that year. They were reaped during the crop of 1937. This series, therefore, represented the first to be tested under the new scheme, and, on that account, the results are of unusual interest.

The plantings were laid out as follows: The proven plus semi-proven crosses were split into two lots, i.e. (1) early and (2) late. In each lot the cross populations were planted in blocks. The nobilised seedlings in the Experimental Cross Group were divided into seedlings of (a) higher and (b) lower degrees of nobilisation. Cross populations of the latter were planted in blocks: selections to provide further breeding material.

The individual seedlings of crosses in the former were placed at random in the Experimental Cross area—this to render legitimate a comparison of population performances.

In considering results, these various categories are treated separately.

PROVEN AND SEMI-PROVEN CROSSES.

The usual methods of field and final selection were employed. The Table below indicates the field and final selections made and the comparative performances of the various crosses.

(1) EARLY GROUP.

Cross.	No. Reaped.	No. Field Selected.	Per Cent. Field Selection.	Final Selection.	Per Cent. Final Selection.
Ba.11569 x S.C. 12/4	679	38	5.6	11	1.6
„ x B. 417	758	73	9.6	24	3.2
„ x Ba. 8069	480	38	7.9	10	2.1
„ x B. 6835	197	18	9.1	4	2.0
„ x Q. 813	189	9	4.8	5	2.7
„ x Burke	158	9	5.7	2	1.3
„ x D. 625	64	7	10.9	0	0.0
„ x B. 6450	72	9	12.5	2	2.8
Bourbon x B. H. 10 (12)	79	8	10.1	2	2.5
Totals and Means	2,676	209	7.8	60	2.3

(2) LATE GROUP.

Cross.	No. Reaped.	No. Field Selected.	Per Cent. Field Selection.	Final Selection.	Per Cent. Final Selection.
Ba. 11569 x B. H. 10 (12)	877	57	6.5	22	2.5
Ba. 11569 x B.603	921	75	8.1	25	2.7
„ x Sealy Seedling	80	4	5.0	2	2.5
Ba. 11569 x D. 625	95	5	5.1	2	2.1
Ba. 11569 x B. 6450	58	3	5.2	1	1.7
Bourbon x B. H. 10 (12)	91	2	2.1	1	1.1
Totals and Means	2,122	146	6.9	53	2.5

This was the first occasion on which first year seedlings were reaped after an average West Indies growing season. The effect of this growing season, longer than that previously used in this trial, was to show up shorter season crosses. Whereas, in the shorter season, these did very well, in the longer season their short growth periodicity was revealed by the presence of tapering canes, comparatively marked arrowing and low weights. A good example was seen in the cross Ba.11569 x S.C. 12/4—which was considered very good in the shorter season trial. It will now be eliminated. The best crosses were:—

Ba.11569	x	B.417
„	x	Ba.8069
„	x	B.6835
„	x	B.6450
„	x	B.H.10(12)
„	x	B.603

The cross Ba. 11569 x Burke was poor, while Ba. 11569 x D.625 seedlings. although looking well in the field, gave extremely poor juice qualities. Both will be eliminated.

The crosses—Ba.11569 x Q.813, Ba.11569 x Sealy Seedling, and Bourbon x B.H.10(12), while giving, in the main only average seedlings, produced some very good individuals. They will be further tried.

EXPERIMENTAL CROSSES.

(1) *Higher Nobilisations*: These consisted of approximately 2,400 seedlings derived from 38 crosses. The crosses were chiefly 4th and 5th *glagah* nobilisations, a few *chunnee* nobilisations, while some were of mixed derivation.

They were reaped about mid-crop and the usual field data obtained, including Zeiss Hand Refractometer readings for an adequate number of each cross.

Field and final selections were made; the latter, 79 in all, to be further tested in Barbados prior to selecting for test in other British West Indian Islands.

In order to compare the various crosses being tested, tables of field and final selections were prepared. In addition, an exhaustive analysis is being made of the performances in several important characters of cross populations. Future breeding policy, in nobilisation work, is guided by the data presented in these tables.

(2) *Lower Nobilisations* : These were nobilisations of lower degree : thus.—

Uba	x	B.H.10(12)
„	x	B.2935
„	x	P.O.J.2878
Kassoer	x	B.H.10(12)
Synthetic Kassoer	x	„
Toledo	x	„
Ba.11569	x	*Sacc. spontaneum*

Populations of each cross were kept distinct in blocks. Selections were made with a view to providing material for further nobilisation work. In all, 29 were selected.

In general, it may be stated that the longer season employed in this trial showed up the marked arrowing tendency in the nobilised seedlings. In selecting, attention was paid to avoiding arrowing, or at least markedly arrowing seedlings. This should be of undoubted advantage in selecting seedlings for the British West Indies. Moreover, the analysis of the cross population data should be much more reliable in assessing the comparative values of crosses for conditions in the British West Indies.

(iv) MULTIPLICATION AND MINOR SELECTION PLOTS— B.35′ SERIES (NOBLE VARIETIES)

These were selected from the First Year Seedling Trials in 1935. In all, 114 were selected. All were multiplied during 1935 at Codrington Experiment Station, and, in November of that year, sent to Dodds Station for further multiplication, gumming disease resistance tests and minor selection. The early group multiplication plots were reaped at Codrington during the crop of 1936. and this data used in making a selection for that group at Dodds in 1936, during a critical examination of all seedlings.

Of the 114 seedlings, 61 were eliminated on account of poor appearance in the field or susceptibility to gumming disease. This left 53 which were planted in Second Year Seedling Trials for season 1936—38.

(v) SECOND YEAR SEEDLING TRIALS. B.35′ SERIES (NOBILISATIONS).

Since this is a new type of trial, a note of explanation is given here.

This type of trial is primarily intended to give a reasonably adequate second year's test in Barbados of selected *nobilised* first year seedlings prior to making final selections for test in various British West Indian Islands. Such nobilised seedlings, in the First Year Trial, constitute the majority of the so-called Experimental Cross Group. The term nobilised here implies that they are derived from wild parents crossed several times to Barbados noble varieties. The object of this process of nobilisation in Barbados is chiefly to provide seedlings for (1) areas in the British West Indies which have good growing conditions but are dominated by mosaic disease—hence mosaic disease resistance is desirable; and (2), areas in the British West Indies which have intrinsically poor soil conditions.

The trial reported here concerns nobilised seedlings selected from the Experimental Cross Group in 1935. These were multiplied during the growing season of 1935, and, prior to planting at Codrington in November of that year, a minor elimination was made. The seedlings remaining for test were divided into two lots, i.e., (1) thick canes for better soil conditions, with possible commercial resistance to mosaic; and (2) thin canes for poor soil areas. These were planted in adjoining trials: in the former B.2935, and in the latter Co.213 being used as standards. There were four randomised blocks in each trial and the plot size was approximately 1/150 acre.

At reaping, data were obtained on plot cane yield, number of rotten canes and sucrose per cent. in juice from an 80 lb. cane sample.

For cane yield, the per cent. standard deviation of the trial was 9.26, and for sucrose 3.47 in the thick-cane trial, while in the thin-cane trial, corresponding figures were 12.8 and 3.44. In view of the very small plot size, these figures may be regarded as highly satisfactory.

Selections were as follows:—

(1) thick-cane trial—B.35151, B.35176, B.35179, B.35187, B.35221 B.35237, B.35245.

(2) thin-cane trial—B.35197, B.35200, B.35204, B.35207, B.35214, B.35247.

All selections were immediately despatched to the Plant Quarantine Station in Trinidad.

Two of the selections were considered sufficiently promising to multiply and put into Select Seedling Trials and Maturity Experiments in Barbados, i.e., B.35187 and B.35245. These will be tested in the same series of trials as the B.34′ noble cane selections noted in the following section.

(vi) SECOND YEAR SEEDLING TRIALS.— B.34′ SERIES (NOBLE VARIETIES).

These were reaped at Dodds and Todds during the 1937 crop. At both stations there were an early and a late group, reaped respectively early and late in crop for each station.

The usual data was taken at reaping and seven seedlings were finally selected for more extensive tests in Barbados. These are:—B.3419, B.3429, B.3439, B.3461, B.3464, B..3479, B..3482. Cuttings of these seedlings were despatched to the Plant Quarantine Station in Trinidad.

With the exception of B.3439, all will be tested during season 1937-39 in Select Seedling Trials and Maturity Expermients. The seedling B. 3439 is sufficiently promising to be tested in Variety Trials during the same season, as an early variety in the lower rainfall black coral limestone soils.

(vii) NOTE ON SEEDLINGS OF THE B.33′ SERIES (NOBLE VARIETIES).

These were selected from Second Year Seedling Trials during the 1936 crop and are:—B.3307, B.3327. These are at present (season 1936-38) undergoing tests in Select Seedling Trials and Maturity Experiments.

(viii) SELECT SEEDLING AND VARIETY TRIALS.— B.30′, B.31′, and B.32′ SERIES.

(a) *The Seedlings Tested.*

(1) *Select Seedling Trials*:

	Plant Canes	B.3013
		B.3216
		B.3267
		B.3234
		B.3259
„ „	1st Ratoons	B.3124
		B.3127
		B.3216
		B.3234
„ „	2nd Ratoons	B.3013
		B.3127

(2) *Variety Trials*:

	Plant Canes	B.3124
		B.3013
		B.3234
„ „	1st Ratoons	B.3013
		B.3234

(b) *An Ecological Classification of the Trials.*

This classification is similar to that used in last season's Report. The areas are:—

A. Black and sandy coral limestone soils where average seasonal rainfall is low. On account of low rainfall ratooning is difficult and tonnages are, as a rule, low.

Stations in this category were:—

(a) Select Seedling Trials. Plant Canes. Sunbury, River.

(b) Variety Trials. Plant Canes. Spring Garden, Coverley, Sandford, Six Men's, Gibbons.

(c) Variety Trials: First Ratoons. Pollards.

B. Black coral limestone soil area of low-intermediate rainfall. On account of a better rainfall, a certain amount of ratooning is practised in this area. The extent of ratooning would increase were strong ratooning seedlings available.

Stations in this category were:—

(a) Select Seedling Trials: Plant Canes. Yorkshire.
(b) Select Seedling Trials: First Ratoons. Lower Greys.

C. Valley deep black coral limestone soil area, low-intermediate rainfall. This area may experience a certain amount of waterlogging. A considerable percentage of this area is ratooned.

Stations in this category were:—

(a) Select Seedling Trials. Plant Canes. Bentley.
(b) Variety Trials: Plant Canes. Bulkeley.

D. Red coral limestone soil area, intermediate to high rainfall. One to three ratoon crops are grown here.

Stations in this category were:—

(a) Select Seedling Trials. Plant Canes:
Lears
Bowmanston
Fairview
(b) Select Seedling Trials. First Ratoons
Lammings
Apes Hill
Fisher Pond
Hothersal
(c) Select Seedling Trials. Second Ratoons.
Cottage
Guinea
Wakefield
(d) Variety Trials. Plant Canes.
Blowers
Cliff
Society
Claybury
(e) Variety Trials. First Ratoons
Vaucluse
Ashbury
Kendal
Lancaster
Clifton Hall
Farmers
Mount Wilton

(c) *Rainfall during the Season.*

The average rainfall for a number of stations over the Island for 1936 was 60..32 inches. This practically equals the average annual rainfall for the forty-year period, 1890-1929:—60.87 inches.

The monthly distribution of the 1936 rainfall was as follows:—

January	1..74	May	3.67	September	5.63
February	1.18	June	9.45	October	7.57
March	.12	July	12.00	November	6.64
April	1.78	August	6.25	December	4..19

The dry season, January to May, was very severe and stools, especially ratoon stools, were backward. The rains of June, July and August were excellent, and this, following on the drought, encouraged high tillering. The rains from September to December were below average and somewhat retarded growth.

January, 1937, brought exceptionally high rains which caused renewed late growth, particularly in ratoons. During the crop months, February to May, rains were very low.

As a result of the rainfall distribution, canes were very vigorous during crop, and little rotting or drying out was seen. Juices, however, were low at the beginning of crop, but improved, at first slowly, later more rapidly, until excellent juices were reached from mid to late crop.

The tonnages of the 1937 crop were approximately similar to those for the 1936 crop and the slightly lower sugar production of the former year was probably due to the low juice qualities early in crop in 1937.

(d) *Results of the Trials.*

In select seedling plant cane trials, the following routine data is obtained:—(1) cane tonnage, (2), number of rotten canes, (3) complete cane chemical analyses from plot sample bundles, and so (4) calculation of the saccharose per acre. Statistical analyses of cane tonnages and sucrose per cent in juice are made. In Select Seedling ratoon trials, cane tonnages and number of rotten canes only are obtained. Thus, for seedlings, comparative cane chemical data are obtained in Select Seedling plant cane trials only, and the figures obtained serve for approximating the saccharose yield of seedlings in Select Seedling ratoon and Variety Trials.

The results are presented in a series of figures. The Figures present, for plant cane Select Seedling Trials, the important figure—yield of saccharose per acre, and for ratoon Select Seedling Trials and Variety Trials the tonnage of cane per acre. The small lines, alongside ratoon Select Seedling and Variety Trials, represent established significant differences in tonnages between seedlings.

The various categories are considered in turn:—

Category A. (*Figure* 1).

Two plant cane Select Seedling Trials, five plant cane Variety Trials and one first ratoon Variety Trial were reaped in this category.

None of the seedlings tested in the plant cane Select Seedling Trials showed promise of even equalling the standard B.2935. They will be discarded for this category.

The plant cane Variety Trials were designed to test B. 3124 as an early variety. It was decidedly inferior in tonnage to B. 2935, and was little, if at all, better than the early variety B. 726. The latter is to be preferred to B. 3124, it being a sounder variety. B. 3124 will be no further tested.

The conclusion for this category is that B. 2935 is easily the best variety. Its limitations are its low juice quality early in crop, and its irregular ratoon springing under difficult conditions. An early ripening and stronger ratooning seedling is desirable here. Two seedlings are being tested for this purpose:—B. 3307 and B. 3439.

Category B. (*Figure* 2).

One plant cane and one ratoon Select Seedling Trial were reaped here.

The seedlings B. 3234 and B. 3259 are definitely inferior to the standard varieties:—B. 2935 and B. 726. B. 3216 yielded well in the late reaping of the plant cane and in the ratoon trial. This seedling, however, is very susceptible

FIG I. CATEGORY A.

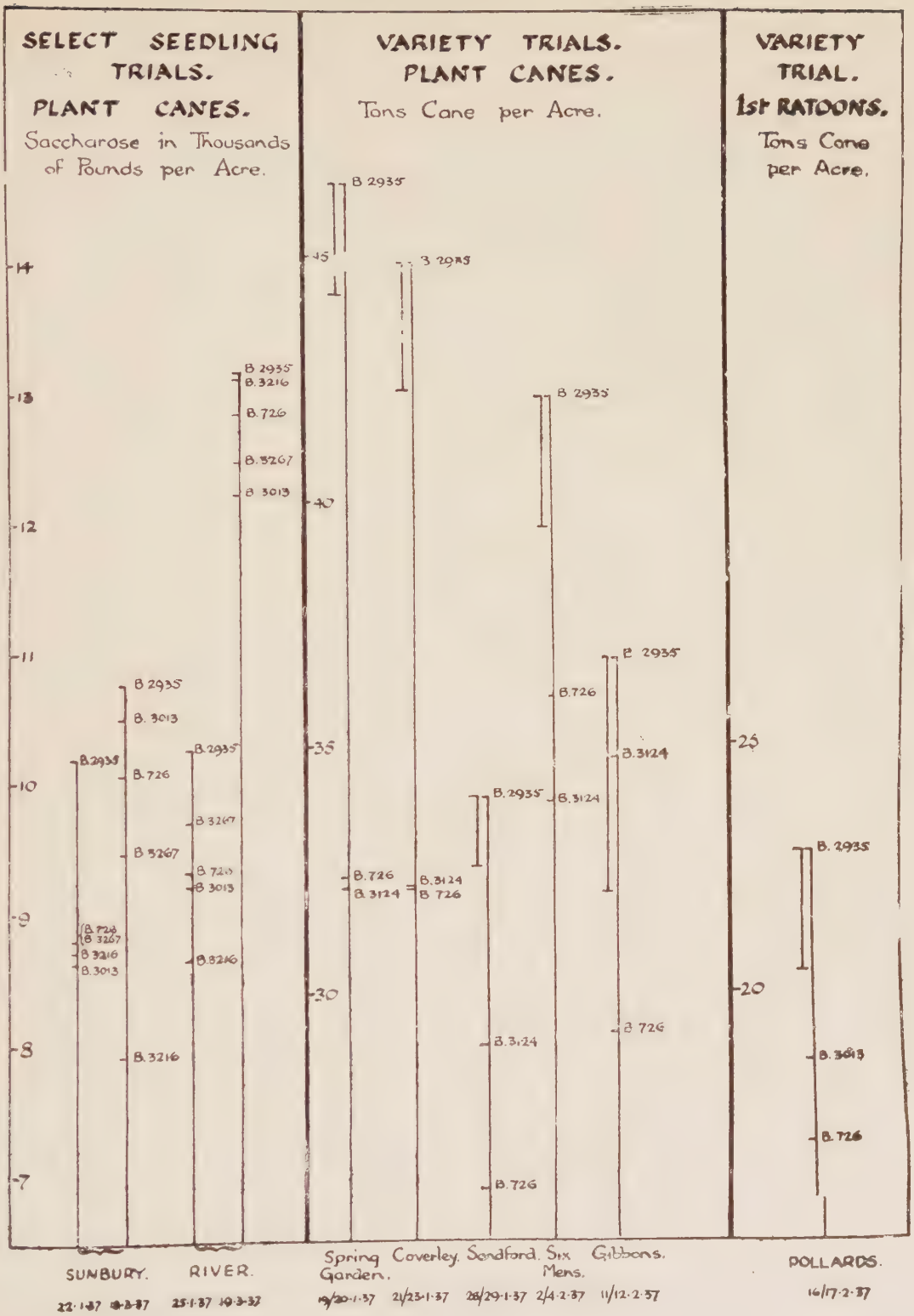


FIG II. CATEGORY B.

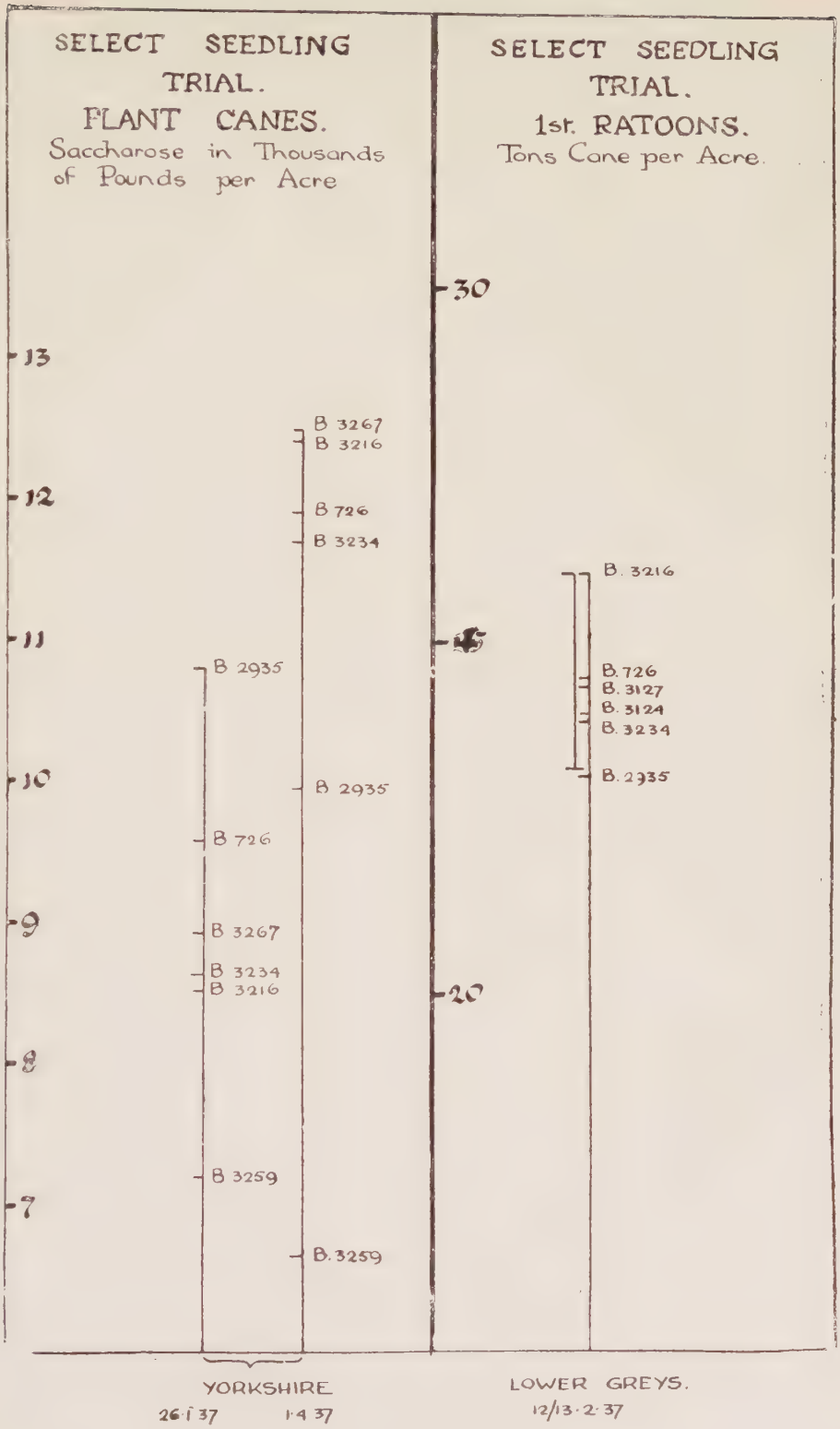


FIG III. CATEGORY C.

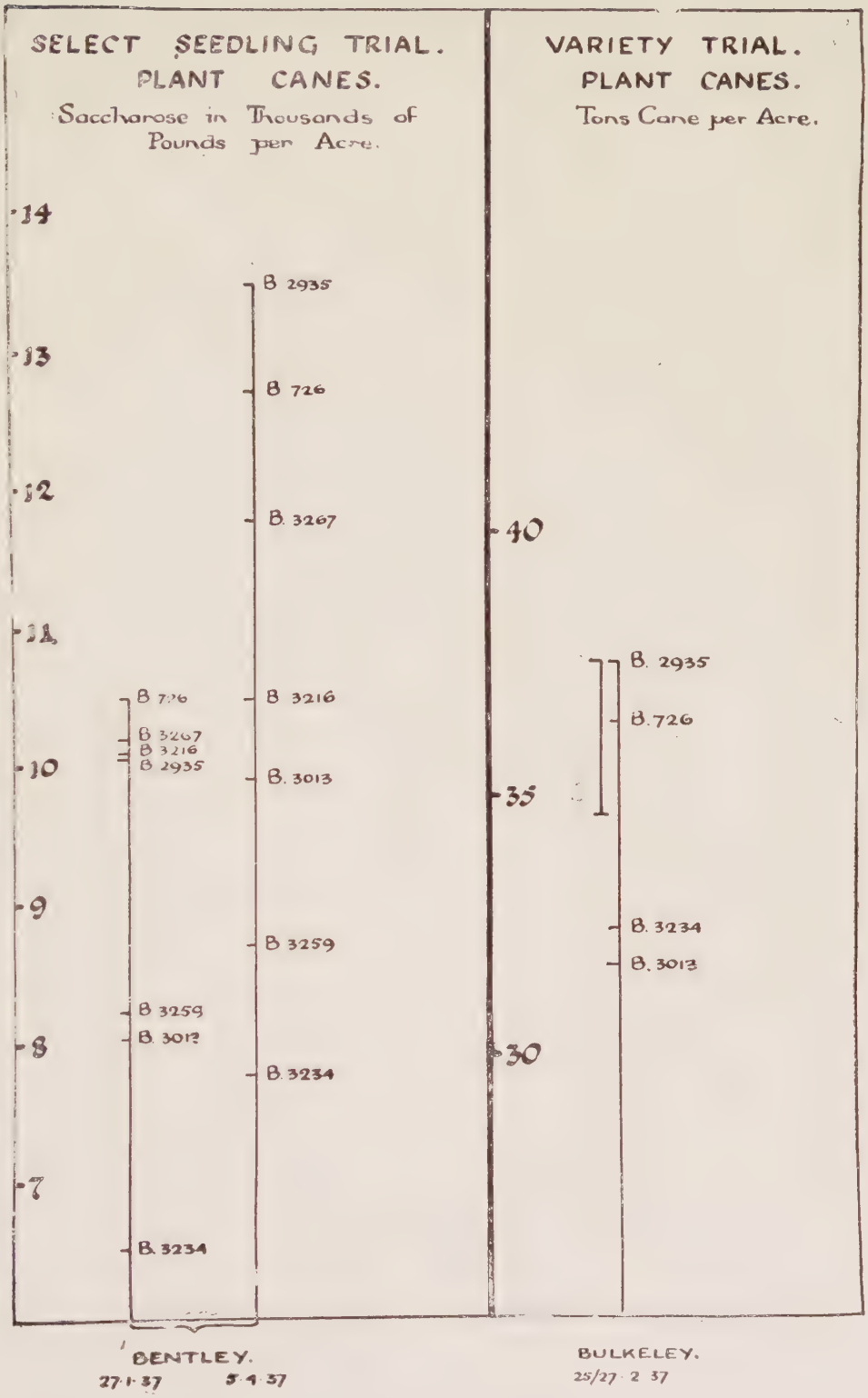


FIG IV. CATEGORY D.

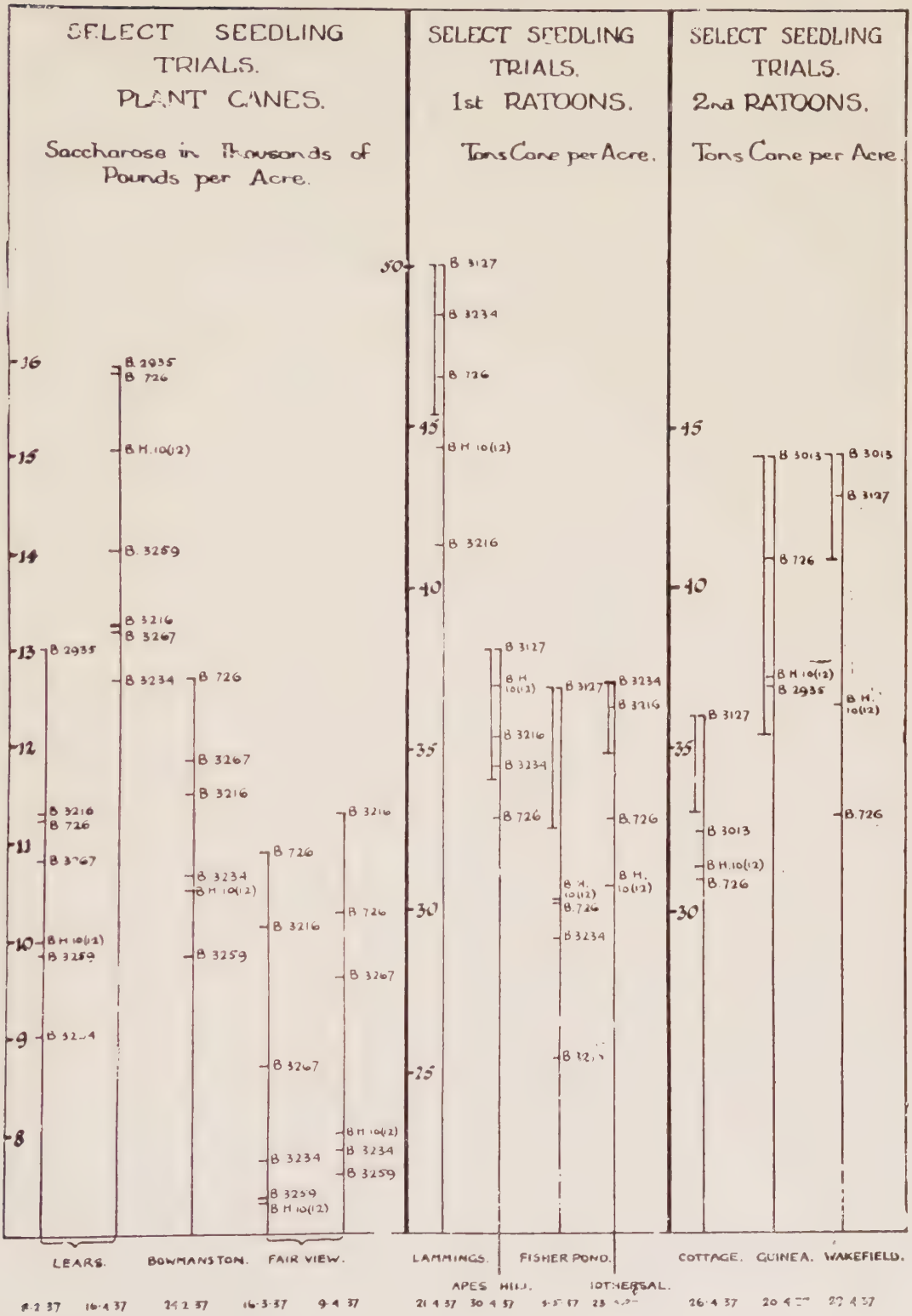
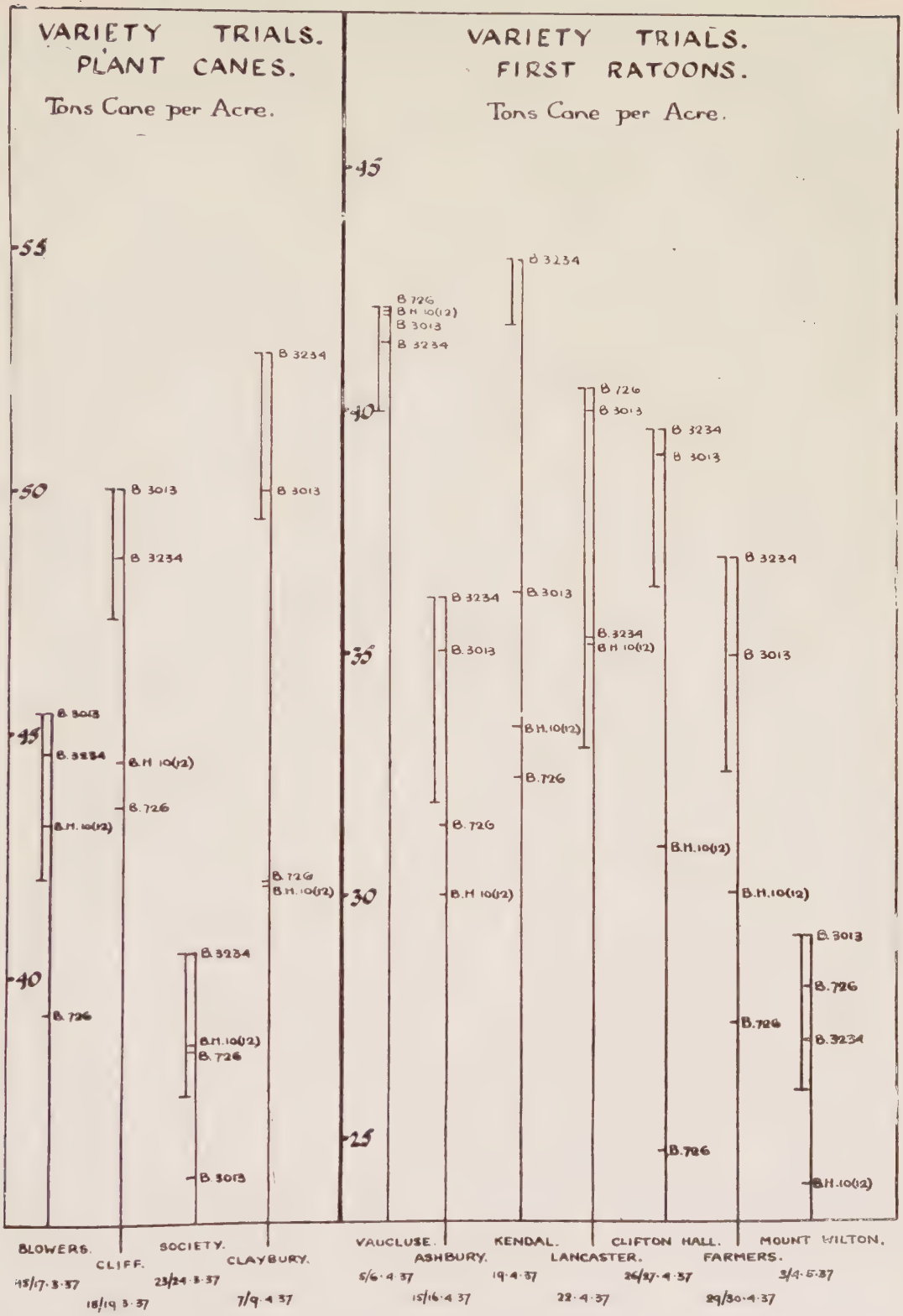


FIG V. CATEGORY D (concl).



to the Red Rot fungus and it is therefore dangerous to consider it any further. B.3267 was reaped in the plant cane trial. It was indifferent in the early reaping and first in the late reaping. It gave a heavy yield of cane of low juice quality. Actually, in saccharose yields, it was no better than B.726 over the two reapings. Moreover, it shows a tendency to rot as crop progresses. It is not promising as a standard cane.

In the ratoon trial B. 3127 was the best of the seedlings, yielding close to B. 726. It will be further tested in this category. B. 3124 was not so good as B. 726 and it will be discarded.

As expected, B. 726 compared favourably with B. 2935. It must not be forgotten, however, that, in a season of lower rainfall than the one considered here, B.2935 would undoubtedly outyield B.726 appreciably. It is, therefore, safer to have the greater part of the acreage in B. 2935.

Category C. (*Figure* 3).

It is unfortunate that the Select Seedling Trial at Carrington and the Variety Trial at Constant were not ratooned, more particularly since B. 3127 was in the former and B. 3013 in the latter.

One plant cane Select Seedling and a Variety Trial were reaped. The standard here is B. 726. The seedlings B. 3013, B. 3216, B. 3234, B. 3259, and B. 3267 were all inferior to the standard. In the Variety Trial, the canes of B. 2935 were rotting markedly. It is this feature which makes this variety a very doubtful proposition in valley soils. It should not be planted here.

The seedling B. 3127, during tests of previous seasons gave excellent yields in valley soils, and it is being tested here in two Variety and one Select Seedling Trial, during the present season 1936-1938.

Category D. (*Figures* 4 *and* 5).

The standard varieties here are B. 726 (early) and B.H. 10(12) (late). A large number of trials—21 in all—were carried out. This was due to (1) more ratooning in this area and (2) a large scale series of tests of the seedlings B. 3013 and B. 3234.

The seedlings tested were:—B. 3013, B. 3127, B. 3216, B. 3234, B. 3259 and 3267.

The following do not show promise of becoming standard varieties—B. 3216, B. 3234, B. 3259, and B. 3267. These are considered here.

B. 3216. This seedling grows strongly and, as a rule, gives good yields of cane and saccharose. It is, however, liable to rot very quickly during crop (c.f. Lears, Lammings and especially Fisher Pond). This feature is obviously highly undesirable in a commercial variety. For this reason, it will be discarded.

B. 3234. This seedling gives very high plant cane and especially ratoon tonnages. In these respects it is very close to B. 3013. The latter, however, is to be preferred on account of a very superior juice quality. The promise of B. 3234 has therefore been masked by the greater promise of B. 3013. B. 3234

will not be recommended for commercial plantings, but will be retained by the Department of Agriculture.

B. 3259. This seedling ripens very early and has very high juice quality. It is however liable to rotting and gives very low cane tonnages. It is definitely inferior to the standards and will be discarded.

B. 3267. In red soils this seedling gives cane yields approximately equal to the standard varieties, but a very inferior juice quality. It will be discarded.

The elimination of the above seedlings leaves two for further detailed consideration, i.e. B. 3013 and B. 3127.

These are considered here:—

B. 3013. In red soil trials during the season under review, this seedling was reaped in three second ratoon Select Seedling Trials, four plant cane and seven first ratoon Variety Trials. The standards were:—B. 726 and B.H. 10(12). B. 3013 outyielded the standards at three out of four plant cane Variety Trials, five out of seven first ratoon Variety Trials, and in all second ratoon Select Seedling Trials.

This seedling's performances in **red soils**, since it reached Select Seedling Trial stage, are summarised below.

B.3013 *v.* B.726 AND B.H.10(12)—RED SOILS 1934/37.

(*a*) *Tons Cane per Acre.*

(i) Plant Canes.

Year.	No. of Trials.	Variety and Average Yield Cane per Acre.		
		B.3013	B.726.	B.H.10(12)
1934	3	37.43	36.89	36.57
1935	5	33.77	36.20	35.14
1936	3	40.00	35.86	38.78
1937	5	47.08	39.92	42.61
Average 1934/37 ..	22	39.80	37.90	38.52

(ii) First Ratoons.

Year.		Variety and Average Yield Cane per Acre.		
	No. of Trials.	B.3013	B.726	B.H.10(12)
1935	1	34.20	34.00	28.90
1936	3	36.12	30.33	31.60
1937	7	38.86	34.69	34.50
Average 1935/37 ..	11	37.69	33.44	33.20

(iii) Second Ratoons.

Year	No. of Trials.	B.3013	B.726	B.H.10(12)
1937	3	40.54	35.32	35.06

(*b*) *Per Cent. Sucrose in Cane.*

Year	No. of Trials.	B.3013	B.726	B.H.10(12)
1934-35	7	15.19	15.41	14.08

Observations.

With regard to **tonnage of cane** as a **plant cane**, B. 3013 outyielded the standards in three out of four years, especially in 1936 and 1937. The season affecting the 1936 crop was one of higher than average rainfall, that affecting the crops of 1934 and 1937 being average rainfall. The rainfall affecting the 1935 crop was well below average. The conclusion is that B. 3013 in low rainfall years will yield slightly less than the standards, while in average and especially above average rainfall years, it will decidedly outyield the standards.

It is as a **ratooner**, however, that B. 3013 is markedly superior to the standards, and this even in seasons of below average rainfall (c.f. 1935 yields of first ratoons). It is probable that, in addition to increasing average ratoon yields, B. 3013 will ratoon economically for more seasons than the standards. In this respect, it was noticeable throughout the trials that B. 3013 retains its fresh appearance throughout crop and springs very readily and strongly after being cut.

With regard to **per cent. sucrose in cane,** B. 3013 is seen to be close to B. 726, and definitely superior to B.H.10(12). Maturity experiments have shown it to ripen very soon after B. 726. It is an unusually sound seedling, little cane rot being experienced, and is comparatively little attacked by rats.

B. 3013 has undoubtedly shown, by its performance in the trials noted here, that it is superior to the standards in **red soils.** In the coming planting season it will be recommended in these areas for an approximate 50 per cent. planting.

B.3127. This seedling is one year younger than B.3013. Consequently less data is available and any conclusions made here are only tentative.

During the season under review, it was reaped in one first ratoon Select Seedling trial in Category B, in three first and two second ratoon Select Seedling trials in Category D.

In the ratoon trial in the low-intermediate rainfall black coral limestone soil area (Category B) it yielded equal to B. 726, in the first and second ratoon trials in red soils (Category D) it outyielded the standards—B. 726 and B.H. 10(12)—in all trials: in the second ratoon trials by large margins.

Its strong ratooning powers, noted in last season's Report, are therefore again evident this crop.

This seedling has first class juice qualities and an average to above average fibre content.

It is hoped that it will have a wider adaptation than B. 3013: especially does it give promise for valley soils (Category C) and low-intermediate rainfall black soils (Category B.)

(e) *Note on Select Seedling and Variety Trials Being Conducted During The Present Season* 1936-38.

Eight Select Seedling Trials were planted in 1936. B. 3013 has now been incorporated as a standard variety in red soil trials, and is being further tested in valley soils, and low-intermediate rainfall black soils. B. 3127 is being tested in all stations, i.e. over all ecological conditions. New seedlings to the trials are B. 3307 (in lower rainfall districts), B. 3327 (in low-intermediate to high rainfall districts) and B. 3439.

Twelve Variety Trials were planted. These are designed to test B. 3127 against standard varieties, thus:—

(1) Low and low-intermediate rainfall black soils (Categories A & B) standards—B. 2935, B. 726 .. .. .. 5 trials.

(2) Valley Soils (Category C) standard—B. 726 .. .. 2 trials.

(3) Red Soils (Category D) standards—B. 726, B.H. 10(12) .. 5 trials.

APPENDIX I.

Sugar Cane Breeding, Seedling Raising and Field Nursery Planting. 1936-37.

Details of Crosses made, their Germinations, Numbers Potted and Numbers Planted in Field Nursery.

Cross.	Group.	No. Germinations. (Nov.-Dec. 1936).	No. Potted (Jan.-Feb. 1937)	No. Planted in Field Nursery. (Mar-Apr. 1937)
Ba.11569 x B.H.10(12) ..	Proven Cross *Saccharum officinarum.*	14,832	3,320	2,718
.. x S.C. 12/4 ..	„	8,223	1,570	0
„ x B.603	„	2,689	2,160	1,733
.. x Ba.8069 ..	„	4,339	1,000	862
„ x B.417	„	2,248	1,278	989
.. x B.6450	Semi-Proven Cross. *S. officinarum.*	774	633	529
.. x Burke	„	103	0	0
.. x B. 6835	„	2,093	1,160	912
„ x B. 693	„	571	506	400
„ x Q. 813	„	365	337	280
„ x D. 625 ..	„	0	0	0
Bourbon x B.H.10(12) ..	„	674	550	450
B. 3013 x B. 2935	„	917	872	710
B. 3138 x B. 2935	„	85	74	40
		37,922	13,460	9,623
	Experimental Crosses Nobilisations. (a) *S. spontaneum.*			
Ba.11569 x Dacca	(i) India 1st degree	110	100	76
B.3013 x B.35250	2nd „	190	180	160
„ x B.35251	2nd „	699	180	150
		999	460	386

APPENDIX I. (*Contd.*)

Cross.	Group.	No. Germinations. (Nov.-Dec. 1936).	No. Potted (Jan.-Feb. 1937)	No. Planted in Field Nursery (Mar-Apr. 1937)
	(ii) Celebes			
Toledo x S.C.12/4	2nd degree	167	150	125
B. 35197 x B. 603	3rd degree	30	27	25
B. 35204 x B. 2935	3rd „	762	170	160
B. 35247 x B. 603	3rd „	24	20	16
		983	367	326
	(iii) Java			
Kassoer x B. 2935	2nd degree	15	14	9
B. 35257 x B. 2935	3rd „	71	50	50
B. 35261 x B. 2935	3rd „	192	55	45
B. 35263 x B. 2935	3rd „	327	50	40
B. 35267 x B. 2935	3rd „	1	0	0
B. 35268 x B. 2935	3rd „	9	9	9
P.O.J. 2725 x S. C. 12/4 ..	4th „	742	0	0
B. 3013 x P.O.J. 2878 ..	4th „	1,225	498	370
B. (30) L.6 x B.H.10(12) ..	4th „	1,594	200	150
M.B. 148 x B. 2935	4th „	202	180	130
M.B. 96 x B.2935	4th „	653	0	0
MI. 20 x B. 6835	4th „	424	120	112
B.3274 x S. C. 12/4 ..	4th „	127	100	85
B.3285 x B.H.10(12) ..	4th „	1,353	200	180
B. 3286 x B. 2935	4th „	55	0	0
Ba.11569 x B.3384	4th „	122	59	50
B. 33101 x B. 2935	4th „	273	50	45
B.3172 x B. 2935	5th „	1,822	160	142

APPENDIX I. (*Contd.*)

Cross	Group	No. Germinations. (Nov-Dec., 1936)	No. Potted (Jan-Feb., 1937)	No. Planted in Field Nursery (Mar-Apr. 1937.)
B. 3215 x B.H.10(12) ..	5th degree	6,621	200	190
B. 3238 x B. 2935 ..	„ „	1,161	100	80
B. 3320 x B. 603	„ „	60	55	40
B. 3321 x B.H.10(12) ..	„ „	2,887	150	109
Ba.11569 x B. 3334	„ „	1,963	100	0
B. 3335 x B.2935	„ „	3,388	50	30
B. 34102 x B. 2935	„ „	4,890	50	45
B. 34131 x B. 603	„ „	56	55	40
B. 35225 x B. 2935	„ „	404	50	40
Ba.11569 x B. 35224	„ „	293	50	47
Rock Hall x B. 35176 .	„ „	9	7	5
B. 35230 x B. 603	6th „	10	8	7
B. 35185 x B. 2935	6th „	240	100	95
		31,190	2,620	2,135
	(b) *S. barberi*			
Ba.11569 x P.O.J. 234 ..	2nd degree	28	26	18
P.O.J.2379 x B.H.10(12) ..	„ „	18	0	0
B. 35211 x „ ..	3rd „	275	209	160
B. 3365 x B. 2935 ..	3rd „	580	160	162
B.35206 x B. 603	4th „	250	240	180
B. 35214 x Ba.6032	4th „	0	0	0
		1,151	635	520

APPENDIX I. (*Concluded.*)

Cross.	Group.	No. Germinations. (Nov.-Dec. 1936).	No. Potted (Jan.-Feb 1937).	No. Planted in Field Nursery (Mar-Apr. 1937).
	(c) *S. sinense*			
B.35271 x B.2935	2nd degree	25	25	18
B.. 35273 x B. 2935	2nd degree	3	0	0
Ba. 11569 x B. 35272	2nd degree	6	6	4
„ x B. 35276	2nd degree	52	50	38
		89	81	60
	(d) mixed derivation.			
B. 3238 x B. 35253	..	1,944	200	180
B. 3321 x B. 35212	..	84	76	65
Hathooni x B.34110	..	0	0	0
P.O.J. 2725 x B. 35243 ..	..	4,687	260	190
Co. 213 x B. 3317	..	4	0	0
B. 3013 x B. 35221	..	218	200	160
B. 35218 x S.C. 12/4 ..	..	157	100	90
Ba. 11569 x Co. 290	..	20	18	10
B. 3124 x Co. 290	..	0	0	0
M.D. 47 x B. 34116	..	243	200	160
B. 3215 x B. 35164	..	20	19	12
Ba.11569 x B. 3364	..	106	0	0
„ x B.34160	..	529	200	190
P.O.J. 2725 x Co. 281 ..	..	499	200	166
B. 3368 x B. 35236 . ..	..	45	40	30
B. 3368 x B. 35162	..	2	0	0
P.O.J. 2725 x B. 34107 ..	..	2,038	200	170
	..	10,596	1,713	1,423
GRAND TOTALS ..	..	82,930	19,336	14,473

APPENDIX II.

Sugar Cane First Year Seedlings—B 38′ Series.

List of Crosses and their Numbers of Seedlings Planted in the Field Nursery (April, 1936) and the First Year Seedling Trial (October and November, 1936).

Group.	Cross.	No. in Field Nursery	No. Planted in First Year Seedling Trial.
Proven Crosses .. .. (*Saccharum officinarum*)	Ba. 11569 x B.H.10(12)	730	436
	„ x S.C.12/4 ..	850	491
	„ x B.603 ..	430	282
	„ x B.8069 ..	295	121
	„ x B.417 ..	1,160	528
Semi-Proven Crosses .. (*S. officinarum*)	Ba. 11569 x E.K.28 ..	500	268
	„ x Q.813 ..	240	128
	„ x Burke ..	280	181
	„ x B.6835 ..	1,260	506
	„ x D.625 ..	220	145
	„ x B.694 ..	380	320
	„ x B.693 ..	560	433
	„ x Badila ..	770	397
	Bourbon x B.H.10(12)	75	43
	„ x B.2935 ..	20	8
	B.3013 x B.H.10(12)	130	91
	B.3138 x B.2935 ..	170	129
		8,070	4,509

APPENDIX II— (*Contd.*)

Group	Cross.	No. in Field Nursery	No. Planted in First Year Seedling Trial.
Experimental Crosses			
Nobilisations			
(a) *S. spontaneum*			
(i) Celebes			
3rd degree ..	B.3352 x B.H.10(12)	30	24
		30	24
(ii) Java			
2nd degree ..	Synthetic Kassoer x B.2935 ..	140	142
2nd degree ..	Kassoer x B.6835 ..	230	70
3rd ,, ..	P.O.J.2364 x B.2935 ..	140	100
,, ,, ..	,, x B.H.10(12)	30	20
,, ,, ..	,, x S.C.12/4	80	60
,, x 4th degree ..	B.3215 x P.O.J.2878	50	40
4th degree ..	B.(30)L6 x B.H.10(12)	250	160
,, ..	B.3353 x B.H.10(12)	65	50
,, ,, ..	ME.72 x B.2935 ..	38	30
,, ,, ..	MD.47 x S C.12/4	50	40
,, ,, ..	P.O.J.2725 x S.C.12/4	160	100
,, ,, ..	MI.20 x S.C.12/4	100	80
,, ,, ..	MB.96 x B.2935 ..	150	100
,, ,, ..	MB.148 x B.2935 ..	45	33
,, ,, ..	B.3285 x B.H.10(12)	80	60
,, ,, ..	B.3286 x B.H.10(12)	120	90
,, ,, ..	B.3274 x S.C.12/4	140	90
,, ,, ..	B.3392 x B.603 ..	50	40
,, ,, ..	B.3354 x B.H.10(12)	50	40
5th ,, ..	Ba.11569 x B.34161 ..	110	90
,, ,, ..	,, x B.3317 ..	240	120

APPENDIX II.—*(Contd.)*

Group.	Cross.		No. in Field Nursery	No. Planted in First Year Seedling Trial.
5th degree ..	B.3215	x B.H.10(12)	670	350
,, ,, ..	B.3335	x B.2935 ..	65	50
,, ,, ..	B.3368	x B.2935 ..	120	90
,, ,, ..	B.3238	x B.2935 ..	125	100
,, ,, ..	B.3013	x B.34130 ..	250	160
,, ,, ..	B.3013	x B.34134 ..	67	50
,, ,, ..	B.34101	x B.2935 ..	37	30
,, ,, ..	B.34102	x B.2935 ..	260	160
			3,912	2,445
(b) *S. barberi*				
1st degree ..	Ba.11569	x Dacca ..	7	3
2nd degree ..	,,	x P.O.J.234	40	30
3rd degree ..	Co.213	x B.391 ..	10	10
,, ,, ..	B.3365	x B.603 ..	70	60
			127	103
(c) *S. sinense*				
1st degree ..	Uba	x B.603 ..	10	3
,, ,, ..	,,	x B.6835 ..	70	22
			80	25
(d) Mixed Derivation ..	B.3215	x *S. Spont.* .. (Local Co.)	500	150
	Uba	x P.O.J.2878	30	10
	P.O.J.2725	x B.3364 ..	320	200
	,,	x B.34107 ..	490	200
	Ba.11569	x B.34116 ..	120	80
	Co.213	x P.O.J.2878	7	7
	,,	x B.3334 ..	6	6

APPENDIX II.—(*Concluded*).

Group.	Cross.	No. in Field Nursery	No. Planted in First Year Seedling Trial.
(d) Mixed Derivation .. (Concluded.)	MD.47 x Co.281 ..	180	100
	MD.47 x P.O.J.234	430	250
	P.O.J.2725 x B.3358 ..	280	150
	P.O.J.213 x P.O.J.2878	55	40
	Ba.11569 x Co.290 ..	10	10
		2,428	1,203
GRAND TOTALS ..		14,647	8,309

II. SPECIAL INVESTIGATIONS IN SUGAR CANE.

(i) GROWTH MEASUREMENTS AND MATURITY EXPERIMENTS.

These are conducted each year at two stations, representative of the low rainfall and high rainfall districts of Barbados. Their object is to obtain information, for those seedlings which reach the Select Seedling stage, on the effect of environment on growth and on the rate of vegetative and chemical maturity. Growth measurements are carried out on Select Seedlings and standard varieties at fortnightly intervals during the growing season, and the Maturity Experiments are reaped at three times—early, medium and late —at each station. From the knowledge so obtained, it is possible to allocate each seedling for further trial to its most favourable environment. These experiments constitute an important phase in the scheme of seedling trials, whose aim is to provide the several environments in the British West Indies with high quality commercial seedlings.

For the season ending with the crop of 1937, growth measurements were made on, and maturity data obtained for, the seedlings B.3013, B.3216, B.3234, B.3259 and B.3267. The seedling B.3124 was re-included in the experiment for maturity determination.

During the present season, growth measurements are being made on the seedlings B.3127, B.3307, B.3327 and B.3439.

Data are obtained for the standard varieties B.H.10(12), B.726, B.2935 and B.3013 as a basis for comparison.

Growth measurements on first ratoons are made at the high rainfall station. For the present season, B.H.10(12), B.726, B.3013 and B.3267 are being measured.

(ii) GUMMING DISEASE INVESTIGATIONS.

Gumming disease resistance tests are conducted each year on all seedlings selected at the reaping of the first year trials of the previous season. From the results of these tests it is possible to eliminate seedlings showing more than a prescribed minimum susceptibility to the disease. In addition, from the data accumulating from year to year, valuable information on the inheritance of gumming disease resistance is secured.

Details of the methods of conducting gumming disease trials, and of the results obtained, have been published (11, 19).

During 1936, records were taken for one hundred and fourteen noble cane seedlings, and for ninety-nine seedlings which are nobilised derivatives of several species of *Saccharum*.

On account of the change-over to the new first year seedling trial scheme, involving a field nursery stage from April to October and a first year trial over the full growing season, there were no first year seedlings reaped at the 1936 crop. Consequently, for the present season there is no gumming disease resistance trial. Routine trials will be re-started in 1938, with the B.37′ series of seedlings.

During the year under review, the information obtained on the inheritance of gumming disease resistance since 1930 was summarised and published (19). A condensed account of this follows:

(a) In a previous publication (11) the results obtained from 1930 to 1934 were presented, showing the resistances of several groups, classes and sections of varieties and seedlings. Since that date, information on the resistance of more than three hundred and fifty additional varieties and seedlings has become available, and is now incorporated with the previous results to bring the data up to date.

(b) The noble cane seedlings show a mean of 73% resistant individuals, though it is noted that within this group there are considerable differences in the percentages of resistant seedlings produced from the individual crosses. Further, it is significant that the percentages of resistant seedlings thrown by individual crosses from year to year remain remarkably constant.

(c) From crosses between the susceptible Ba.11569 and several noble Barbados male parent varieties, it is found that the percentages of susceptible types in the seedling populations vary approximately with the susceptibility of the male parents employed.

(d) Seedlings raised from crosses involving the blood of *Saccharum spontaneum* and *S. barberi* exhibit a very high percentage of resistant types. Even in the fourth and fifth nobilisations in the glagah blood line, resistance percentages of 96—100 are found.

(iii) ROOT DEVELOPMENT INVESTIGATIONS.

A detailed account of the second root development investigation, conducted in 1935-36 has been published (14). This involved examinations of root development in the varieties B.H. 10(12), Ba.11569, B.726, B.2935, P.O.J. 2878, Co.213, Uba and *Saccharum spontaneum*, at four times during the growing season.

Summarised results of the four individual examinations have been presented in the Annual Reports of the Station for 1935 and 1936.

Root development investigations were begun in 1933, as a special line of investigational work of the Station. One of their primary objects was to discover whether particular root-system types could be recognised, in which event the application of the work would be in selecting seedlings for particular environments, and in aiding the choice of parents for the breeding work.

The two investigations were essentially of an intensive nature, including a wide range of varieties, whose root development in time was studied under one environment.

It was concluded that, under the conditions obtaining, differences between the root development of varieties rested chiefly in development in time, and not in distribution. These differences in root development in time were, further, shown to be clearly related to differences in development of

above-ground parts. The investigations have, therefore, to some extent interpreted the differences in the development of above-ground parts in terms of differences in root development. The study of the development of above-ground parts is, however, clearly far more convenient than that of root development, and hence in this respect is a more practicable aid to breeding work.

It is admitted that root development investigations have been carried out only in a soil favourable to ready growth of sugar cane, and that information of potential value to the breeding work might be forthcoming from studies in "difficult" soils. Suitable conditions for such experimentation do not, however, occur in Barbados, and there are no facilities at present for the highly desirable studies on root development of varieties in soils in the British West Indies where the growth of noble canes is notoriously poor.

On account of the above considerations, root development investigations have been discontinued for the present, and other investigations initiated, whose application is a more direct and immediate one in the breeding work. These are considered in later sections.

(iv) INVESTIGATIONS WITH THE ZEISS HAND REFRACTOMETER.

(a) *Correlation Studies.*

These were begun in 1935, when a comprehensive series of correlation studies was carried out with the object of assessing the value of the instrument as an indicator of juice quality for use in seedling selection work. A full account of this investigation was published in the Department of Science and Agriculture, Barbados, Agricultural Journal, Vol. 5, No. 1. It was concluded that the instrument furnishes a comparatively simple, and by certain methods, reliable means of indicating seedling sucroses, for use in selection work.

A further series of correlations was possible after the reaping of the First and Second Year Seedling Trials, 1937, using the Zeiss Hand Refractometer data recorded at these trial reapings and correlating with sucrose in juice figures available from the laboratory analysis of milled cane samples. This second series of correlation studies served to corroborate the 1935 results, and to test the practicability of the routine recording of Zeiss Hand Refractometer readings for seedlings at the time of reaping, with the ultimate object of using such brix figures to replace those of sucrose in juice hitherto used.

A full account of this investigation has been presented (19), and only a brief summary is given here:

Using particular sampling schemes, Zeiss Hand Refractometer brix means were calculated for each seedling selected at the reaping of the First Year Seedlings, and plot means calculated for the Second Year Seedlings. Both noble canes and nobilised seedlings were sampled, and ten separate correlation studies were conducted, to represent each type of trial reaped and each time of reaping during the crop period.

The Zeiss Hand Refractometer readings were recorded by the Field Officers in charge of the reaping gangs, each of whom was provided with an instrument and a gouge for extracting juice samples.

In First Year Seedlings, top, middle and bottom positions in each of three canes were sampled, and in Second Year Seedlings each plot was sampled by choosing three typical canes and sampling each at top, middle and bottom positions.

Target diagrams were prepared, and correlations worked out, between mean Zeiss Hand Refractometer brix values and sucrose in juice figures.

It was found that the correlations were again consistently high. Also, the target diagrams indicated that the relationship holds generally for individual seedlings—a feature of obvious importance in considering the use of the instrument for selection work.

It was concluded that the Zeiss Hand Refractometer method, with particular sampling schemes, can safely be substituted for that involving the making of sucrose in juice determinations in comparing juice qualities of first and second year seedlings. In addition, the use of the method allows of a valuable saving of planting material in first year selections, by eliminating the milling of cane samples, and it allows of the sampling of more seedlings by its simplicity in use. This feature is of considerable value in a study of the inheritance of juice quality in sugar cane.

(b) *The Zeiss Hand Refractometer as an Indicator of Ripening.*

This investigation represents a distinct line of research with the instrument, which has as its object the study of ripening phenomena in seedlings, using a precise sampling scheme for making Zeiss Hand Refractometer brix determinations.

Data obtained at the reaping of the Maturity Experiment plots at low rainfall and high rainfall stations in 1935 and 1937 were available. These have been studied, and the results will shortly be available in the form of a Bulletin.

The Maturity Experiments consist of 16-stool variety plots, replicated eighteen times at each station. Six plots of each variety are cut at three times—early, medium and late—during the crop season. Zeiss Hand Refractometer data were recorded for four seedlings at each station in both years. The plots were sampled by selecting eight canes, age-classes being represented in the ratio by weight they occurred in the plot, and making brix readings at four positions in each cane, representative of the four cane quarters.

Top/bottom refractometer solids ratios were calculated and graphed for each seedling at each place and for each time of reaping. These ratios were in each case the quotient of the mean top readings divided by the average of the means for the bottom, second and third cane quarters. Graphs were also constructed to show the relationships between mean Zeiss Hand Refractometer brixes representative of the four cane quarters over the crop period, and the effect of three arbitrary cane age-classes on Zeiss Hand Refractometer brix values.

Working from the hypothesis that ripeness is attained when the top/bottom refractometer solids ratio reaches unity, it was possible to study the effect of season, place, cane age-class and variety on ripening.

In considering the experimental results so obtained, comparisons were made at all stages with observed field phenomena and chemical data available from analyses carried out in connection with the Maturity Experiments and Select Seedling Trial over several crop seasons.

Important information on ripening phenomena in sugar cane, and particularly on the differential ripening rates of seedlings under various conditions, was obtained.

It was concluded that the methods employed in the investigations are reasonably accurate, and it is hoped to continue the studies.

(v) PRELIMINARY INVESTIGATIONS ON ROTTING OF CANE AND RATOONING OF SEEDLINGS.

(a) *Rotting of Cane.*

During the crop season, losses of tonnage through rotting and drying out of cane frequently occur in Barbados. These losses have been noted to be more serious in certain years than in others, and it is well known that certain varieties are liable to suffer severely in this respect, while others, under similar conditions, are less seriously affected.

During the crop of 1937, an investigation was begun with the object of obtaining information on the factors affecting cane rotting and on the nature of the varietal differences which are known to exist in this respect.

The investigation has been, up to the present, essentially of a preliminary nature. Observations were made at the reaping of the Select Seedling Trials, at which potentially promising seedlings and standard varieties are reaped both early and late in the crop season at each of several stations representative of the various districts of the island.

At each reaping, the rotten canes were examined, and classified according to variety, age-class and the type of injury which caused them to become unfit for milling.

It was found possible to make an immediate classification of rotten canes into three categories: (a) those which had been actually killed by moth borer (*Diatraea saccharalis*) or so badly damaged near the base that breakage had occurred, (b) those in which parasitic fungi had gained access by way of moth borer channels and subsequently spread through the canes, and (c) those in which rotting could not be traced to original moth borer holes or other form of mechanical injury. In the latter category it was noted that pathogenic organisms frequently appeared to gain entrance to the canes by way of the root initials at the nodes.

The crop season of 1937 was not marked by an excessive amount of rotting: cases of true parasitic attack of growing canes in an undamaged condition were rather rare. Only at the late reaping at one station was an appreciable amount

of this type of damage seen in the varieties B.2935 and B.3216. Here the rotting appeared to originate from root-initial penetration near the bases of the canes. At other stations rotting in all varieties had generally followed severe attack by moth borer and rats.

It was possible to make observations on the rate at which rotting spread from its original point of entry in the canes of several varieties. This was noted to show considerable variation, and it was concluded that such varietal differences in the rate of spread of secondary rotting are of considerable importance in assessing the resistance of seedlings to the rotting complex.

In cases where pathogenic organisms attacked undamaged canes, it was frequently noticed that this occurred only late in the season and in canes which appeared nearing the end of their vegetative growth cycle. It may be that in such cases some form of physiological breakdown had occurred and that moribund tissues only were attacked. It appears that the elucidation of the problems associated with cane rotting will not be straightforward, and that in considering varietal differences in susceptibility, the growth types of individual seedlings will have to be considered, and probably features of root development as well.

Future lines of investigation on this subject will be directed towards obtaining further information on cane rotting of seedlings in the field, paying particular attention to attack of undamaged canes, and to varietal differences in susceptibility to secondary damage of canes injured by moth borer. It is also hoped to make isolations of the parasites involved, from several localities, with the ultimate object of conducting inoculation experiments under controlled conditions in the field and laboratory.

(b) *The Factors Affecting Ratooning of Seedlings.*

Ratooning is practised to a certain extent in Barbados, more particularly in the higher rainfall regions, but is of greater importance in other islands supplied by the Station. It is evident that in breeding and testing seedlings for these areas, information on the factors affecting ratooning ability of seedlings, and methods of evaluating seedlings in this respect, are highly desirable.

Preliminary investigations on this subject were begun during the season under review.

Under Barbados conditions, varieties are known to differ in their capacity to "come back"—i.e., to produce a satisfactory stand of young shoots from the old cane bases—particularly if conditions are severe in the weeks immediately following the reaping season. It appears that an important attribute of a good ratooning variety is a capacity to produce such primary ratoon shoots under conditions of low rainfall and consequent low soil moisture. It is evident, moreover, that in comparing varieties from this standpoint, several factors must be taken into consideration. Among these are the condition of the old stool bases at the time of reaping, including their root systems, the viability of the underground buds, and the capacity of the old cane bases to withstand the attacks of soil pests and pathogenic organisms.

The method adopted in the preliminary studies which have been carried out, was to make a thorough examination of the stool bases in several varieties at

about two months after the plant canes had been cut. For this purpose the stools were removed from the field, and freed of adhering soil by means of a hose. The individual cane bases were then separated, and records made of the numbers of shoots produced, their origin from upper or lower buds, and the numbers of living and dead buds occurring on the cane bases.

Comparable stools were taken for the several varieties from the replicated plots in various experiments.

It was possible to establish significant differences between varieties in the percentages of buds giving rise to shoots, and in the numbers of viable buds present in the stool bases.

In the Second Year Seedlings, figures were obtained for all selected seedlings at the low rainfall station. These have given indications of rather marked differences in ratooning ability of the seedlings, and they will be available for comparison with the results obtained at the reaping of these seedlings as first ratoons at the high rainfall station in 1938.

It is hoped to continue and extend these studies during the coming season.

(vi) DESPATCH OF SUGAR CANE FUZZ TO TRINIDAD, FLORIDA AND NEW SOUTH WALES.

Fuzz from nine crosses was sent to the Central Plant Quarantine Station, Trinidad, in connection with the scheme of testing the resulting seedling populations for resistance to attack by the froghopper. The information obtained in these tests will be applied in formulating future breeding programmes in Barbados. The following list gives details of the crosses sent to Trinidad, and of the derivation of the parent varieties:

Cross.	Derivation.
Ba. 11569 x B. 6835	*Saccharum officinarum.*
B. 3013 x B. 35250	*Saccharum officinarum* and *Saccharum spontaneum* (India).
Toledo x S. C. 12/4	*Saccharum officinarum* and *Saccharum spontaneum* (Celebes).
B. 3365 x B. 2935	*Saccharum officinarum* and *Saccharum barberi.*
P.O.J. 2725 x S. C. 12/4	*Saccharum officinarum* and *Saccharum spontaneum* (Java).
B. 34102 x B. 2935	*Saccharum officinarum* and *Saccharum spontaneum* (Java).
B. 35185 x B. 2935	*Saccharum officinarum* and *Saccharum spontaneum* (Java).
B. 35206 x B. 603	*Saccharum officinarum* and *Saccharum barberi.*
P.O.J.2725 x B.34107	*Saccharum officinarum, Saccharum spontaneum* (India), *Saccharum spontaneum* (Java) and *Saccharum barberi.*

At the request of the Director of Plant Breeding, fuzz from the following crosses was sent to New South Wales:

Ba. 11569 x B. 3334

B (30)L6 x B.H..10(12).

B. 3274 x S.C.12/4

B. 3215 x B.H.10(12).

These crosses represent fourth and fifth nobilisations in the glagah blood line.

Fuzz from the cross P.O.J. 2725 x Co. 281, involving the blood of *Saccharum officinarum*, *Saccharum spontaneum* (India), *Saccharum spontaneum* (Java) and *Saccharum barberi* was sent to the Quarantine Station, Washington. The resulting seedlings will be tested in Florida.

III. MISCELLANEOUS.

VISITS.

During the period under review, the Geneticist visited Trinidad, Grenada, St. Kitts and Antigua.

The visit to Trinidad was in connection with the sixth meeting of the Advisory Committee of the Station. At the same time an opportunity was taken to observe the growth in multiplication plots of new seedlings from the Station which had recently been liberated from the Plant Quarantine Station. Recommendations were given as to the allocation of each of those to trials in Trinidad.

At the request of the Director of Agriculture, Trinidad, Hon. E. J. Wortley, the Geneticist visited Grenada during the 1937 crop. The object of the visit was to investigate the part played by variety in certain low sugar returns from the Grenada Sugar Factory. At the same time the variety situation in Grenada was again reviewed. The results of this visit have been published in Bulletin No. 13 of the Station.

The Geneticist visited St. Kitts and Antigua during June. These Islands had by that time multiplied the first new consignment of seedlings from the Station so that they were ready for inclusion in trial. The primary object of the visit was therefore to note the growth made by these seedlings and draw up schemes for their effectve testing. In addition, more particularly in Antigua, the present status of commercial varieties was again reviewed in the light of the results of further completed trials and aid was given the local Departments in making estate planting recommendations. This visit is detailed in Bulletin No. 15 of the Station.

DESPATCH OF CUTTINGS OF NEW SEEDLINGS.

During the season under review, twenty-six seedlings were sent to the Plant Quarantine Station to undergo quarantine prior to being sent to the contributing Colonies in the British West Indies.

These may be classified as follows:—

(a) Thick noble-cane seedlings for testing in better soil conditions where mosaic disease is absent or can be controlled—

B.3307, B.3327, B.3267, B.3419, B.3429, B.3461, B.3464, B.3479, B.3482—9.

(b) Thick-cane nobilised seedlings for testing in better soil conditions where mosaic disease is a dominant factor (i.e. in Jamaica):—

B.34123, B.3215, B.3254, B.35151, B.35176, B.35179, B.35187, B.35221, B.35237, B.35245—10.

(c) Thinner-cane nobilised seedlings for testing in Uba and Co.213 areas in Trinidad, Jamaica and Antigua:—

B.3337, B.35197, B.35200, B.35204, B.35207, B.35214, B.35247 —7.

A consignment of cuttings of twenty seedlings was sent to Amani for quarantine prior to being forwarded to Uganda. These were sent at the request of the Uganda Government and were selected as having given good field performances in Barbados and as possessing a parentage likely to endow commercial resistance to mosaic disease.

These were:—

B.3215, B.34130, B.34105, B.35179, B.35245, B.3172, B.34110, B.34123, B.35187, B.3254, B.34137, B.3337, B.352221, B.34134, B.34106, B.35151, B.35237, B.34129, B.34120, B.35176.—20.

PROGRESS IN THE CONTRIBUTING COLONIES OF SEEDLINGS BRED BY THE STATION.

Two recent seedlings, i.e. B.726 and B.2935, are now being planted on a commercial scale in the Islands served by the Station.

B.726 is being planted in B.H.10(12) areas in Trinidad to function as a variety for early reaping in crop. It is chiefly planted in the black limestone soils of the Usine Ste. Madeleine and in the better class soils of the Waterloo estates.

It will be further tested in St. Kitts, Antigua and St. Lucia, although in each of these islands it is being planted commercially on a small scale.

In Grenada it occupies an appreciable percentage of the sugar cane area and is giving highly satisfactory results.

In Jamaica it is reported to be very susceptible to mosaic and its further extension is doubtful on this account.

B.2935 is already the commercial variety in the low rainfall lower lands of St. Kitts. In Antigua it is to be extended throughout the better drained Antigua limestone soils. In St. Lucia it has been highly successful in the Vieux

Fort area. In Grenada it is grown almost exclusively in the Grand Anse section of the lands of the Grenada Sugar Factory.

Two newer seedlings i.e. B.3013 and B.3127 are expected to become commercial varieties in the contributing Colonies. Recommendations for their extensive testing in all Colonies have been issued.

DESCRIPTION OF NEW COMMERCIAL SEEDLINGS PRODUCED BY THE STATION.

It is the intention to publish, as occasion arises, botanical and agricultural descriptions of new seedlings produced by the Station which reach the commercial stage.

During the season under review, a start was made in this direction by publishing in Bulletin No. 14 a description of two new commercial seedlings—B.726 and B.2935.

RAPID MULTIPLICATION OF SEEDLINGS.

In view of the unavoidably low number of cuttings of new seedlings sent to the Islands from the Plant Quarantine Station and of the desirability of testing these seedlings in the Islands as soon as possible, some system of rapid multiplication of the initial planting material received was necessary.

During the season a pamphlet describing methods for rapid multiplication was written by Mr. C. B. Foster, First Agricultural Assistant of the Department of Science and Agriculture, Barbados. Copies of this pamphlet were circulated by the Station to the various Agricultural Departments concerned. The information embodied in this pamphlet has been much appreciated.

IV. PUBLICATIONS ISSUED.

(a) *Annual Reports.*

(1) Report for the Period ending September 30, 1934.

(2) Report for the Year ending September 30, 1935.

(3) Third Annual Report ending September 30, 1936.

(b) *Bulletins.*

(4) Bulletin 1—Report on the Sugar Cane Breeding Problems of Antigua, Trinidad and St. Kitts—A.E.S. McIntosh, Sept. 1933.

(5) Bulletin 2—Report on the Sugar Cane Variety Problems in St. Lucia —A. E. S. McIntosh, June, 1934.

(6) Bulletin 3—Report on a Visit to Jamaica—A. E. S. McIntosh, Sept., 1934.

(7) Bulletin 4—Report on a Visit to Grenada—A. E. S. McIntosh, November, 1934.

(8) Bulletin 5—Investigations into the Root Development of the Sugar Cane in Barbados (1) Root Development in Several Varieties under one Environment.—G. C. Stevenson and A. E. S. McIntosh, Feby., 1935.

(9) Bulletin 6—An Account of the Policy and Methods employed in the Breeding and Initial Stage of Selecting Sugar Cane Seedlings.—A. E. S. McIntosh, June, 1935.

(10) Bulletin 7—Report on a Second Visit to Antigua.—A. E. S. McIntosh, July, 1935.

(11) Bulletin 8—Gumming Disease Investigations in Barbados.—A. E. S. McIntosh and G. C. Stevenson, August 1935.

(12) Bulletin 9—An Account of the Methods employed in Testing and Selecting Sugar Cane Seedlings for Thick-Cane Areas in the British West Indies.—A. E. S. McIntosh.

An Account of the Methods Employed in Carrying out Sugar Cane Seedlings and Variety Trials in Barbados.—A. E. S. McIntosh and C. B. Foster, Sept., 1935.

(13) Bulletin 10—The Yield of Sugar Cane in Barbados in 1936.—August 1936.

(14) Bulletin 11—Investigations into the Root Development of the Sugar Cane in Barbados (2) Further Observations on Root Development in Several Varieties under one Environment. G. C. Stevenson. August, 1936.

(15) Bulletin 12—Sugar Cane Fuzz Storage Experiments.—A. E. S. McIntosh. April 1937.

(16) Bulletin 13—Report on a Second Visit to Grenada, April, 1937.—A. E. S. McIntosh, June, 1937.

(17) Bulletin 14—A Botanical and Agricultural Description of Recently Produced Commercial Seedlings.—A. E. S. McIntosh, June, 1937.

(18) Bulletin 15—Report on a Visit to St. Kitts and Antigua, June, 1937.—A. E. S. McIntosh. July, 1937

(19) Bulletin 16—(1) Studies on Gumming Disease of Sugar Cane. (2) Investigations into the use of the Zeiss Hand Refractometer.—G. C. Stevenson. July, 1937.

(20) Bulletin 17—The Yield of Sugar Cane in Barbados in 1937.—August, 1937.

BRITISH WEST INDIES CENTRAL SUGAR CANE BREEDING STATION.

STATEMENT OF EXPENDITURE FOR 1936—37.

		£	s.	d.
1.	Personal Emoluments	1,119	13	10
2.	Provident Fund	65	0	0
3.	Seedling Trials	399	12	7
4.	Stationery and Publications	74	19	10
5.	Travelling	310	12	4
6.	Contingencies	14	0	4
	Total	1,983	18	11